Total No. of Questions : 9] [Total No. of Printed Pages : 4

(1049)

UG (CBCS) Ist Year Annual Examination

2008

B.Sc. PHYSICS

(Electricity, Magnetism and EMT)

(Core)

Paper : PHYS 102

Time : 3 Hours] **[Maximum Marks : 50**

Note :– Attempt *five* questions in all, selecting *one* question each from Sections B, C, D and E and *seven* sub-questions from Section A. Question No. **1** (Section A) is compulsory.

Section–A

(Compulsory Question)

1. Explain the following :

   (i) What is displacement current ? Give its unit in SI.

   (ii) Why light waves travel through Vacuum whereas sound waves cannot ?

   (iii) Why is ferromagnetism not found in liquids and gases ?

(iv) What are Ferrites ? To what use are they put ?

(v) Is Volume charge density in variant under Lorentz transformation ?

(vi) A current is sent through a hanging coiled spring why does the spring contract in length ?

(vii) Why no current flows through a conductor in absence of electric field ?

(viii) What is the physical interpretation of gradient of a scalar function ?

(ix) What is an irrotational fields ? Give two examples. 7×2=14

Section–B

2. (a) What is meant by curl of a vector ? State and prove Stoke's theorem.

(b) Show that :

$$\vec{\nabla}\cdot(\vec{A}\times\vec{B}) = \vec{B}\cdot(\vec{\nabla}\times\vec{A}) - \vec{A}\cdot(\vec{\nabla}\times\vec{B})$$ 5,4

3. (a) Prove that electric potential due to quadrupole varies inversely as cube of the distance.

(b) Drive the equation of continuity :

$$\vec{\nabla}\cdot\vec{J} + \frac{\partial\rho}{\partial t} = 0,$$

what form will it take for steady currents ? 5,4

Section–C

4. (a) What is Hall effect ? Drive an expression for Hall constant and mention the applications of this effect.

(b) What is Vector Potential ? Show that :

$$\vec{\nabla}\cdot\vec{A} = \frac{\mu_0}{4\pi}\iint\frac{\vec{J}}{r}\cdot\vec{ds}$$

under what condition $\vec{\nabla}\cdot\vec{A} = 0$? 5,4

5. (a) **Show that transformation laws of transforming electric field from one inertial frame of reference to another are given by $E'_{11} = E_{11}$ and $E'_{\perp} = rE_{\perp}$, where symbols have their usual meanings.**

(b) Deduce the Clausius–Mossotti relation for a polarisation of a medium. 5,4

Section–D

6. (a) Show that for non-uniform polarisation :

$$\vec{\nabla}\cdot\vec{P} = -\rho_p$$

(b) The dielectric constant of helium is 1.00074. Find the dipole moment of each atom when a gas is subjected to an electric field of intensity 150 Volt/cm. 5,4

7. (a) Explain ferromagnetism on the basis of domain theory.

(b) Define free and bound currents. Show that :

$$\vec{\nabla} \times \vec{H} = \vec{J}_{free}$$ 4.5

Section–E

8. (a) Show that the impedance of free space for em-wave is 377 Ω.

(b) Drive the equations of plane em-waves in a medium having finite permittivity E, permeability μ and conductivity σ. 4.5

9. (a) Discuss the propagation of a plane em-wave incident normally at a boundary separating two media of different impedances and show that a perfect conductor is a perfect reflector of em-waves.

(b) Define Poynting Vector. What does it represent ? Give its unit in SI. 6.3